3. Quantum Size Effect of the Electric Resistivity on Bismuth Films

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Thin bismuth films with thickness from 100 nm to 540 nm are grown by evaporation method. They are formed of large crystal grains with above 4 μm-diam., and are oriented to $<111>$ direction normal to film surface. Using these films, we are able to study the size effects of the electric resistivity without considering of the scattering from grain bounderies. For above 4 μm-diam., the dependence of grain bounderies on resistivity becomes very small.

At room temperature, experimental results are explained by using the Fuchs-Sondheimer theory, i.e. the classical size effect. At 80 K, the resistivity has periodic variation in addition to the monotonous variation due to the above effect with increasing film thickness. The period is about 30 nm. Its value is well agreement with theoretical value obtained from the quantum size effect.

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